UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. Larry Lawson, Director
Division of Water Program Coordination
Virginia Department of Environmental Quality
629 Main Street
Richmond, VA 23219

Dear Mr. Lawson:

The Environmental Protection Agency (EPA) Region III is pleased to approve the Total Maximum Daily Load (TMDL) report for the aquatic life use impairment on Toms Brook. The TMDL report was submitted to EPA for review in March 2004. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address an impairment of water quality as identified in Virginia's 1998, Section 303(d) list.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations, (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the TMDL for the primary contact use impairment satisfies each of these requirements.

Following the approval of the TMDL, Virginia shall incorporate the TMDL into the Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please don't hesitate to contact Mr. Thomas Henry at (215) 814-5752.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

Decision Rationale

Total Maximum Daily Loads for
the Aquatic Life Use Impairment on Toms Brook

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited water body.

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the TMDL for the aquatic life use (benthic) impairment on Toms Brook. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a margin of safety.
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

II. Background

The Toms Brook Watershed is located in Shenandoah County, Virginia. Toms Brook is a tributary to the North Fork of the Shenandoah River. The impaired segment runs 7.18 miles beginning at its headwaters and terminating at its mouth, the confluence of the North Fork of the Shenandoah River. The 10,506-acre watershed is rural with agricultural (51%) and forested (43%) lands making up 94 percent of the watershed area. The remainder of the watershed is made-up of residential lands.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality (VADEQ) listed Toms Brook (VAV-B50R) on Virginia's 1998 Section 303(d) list as being unable to attain the general standard for the aquatic life use. This decision rationale will address the TMDL for the impairment of the general standard for the aquatic life use. The failure to attain this use was determined through biological assessments of the benthic

macroinvertebrate community.

Virginia's 305(b)/303(d) guidance states that support of the aquatic life beneficial use is determined by the assessment of conventional pollutants (dissolved oxygen (DO), pH, and temperature); toxic pollutants in the water column, fish tissue, and sediments; and biological evaluation of benthic community data.[1] Therefore, a biological assessment of the benthic community can be used to determine a stream's compliance with the state's general standard for the aquatic life use. Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine status of a stream's benthic macroinvertebrate community.[2] This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.[3] Please note that the state is currently in the process of changing this methodology to a stream condition index (SCI) approach.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters. During the 1998 assessment period, Toms Brook was identified as being moderately impaired. Toms Brook continues to be assessed between moderately and slightly impaired using the RBPII approach. When using the SCI method, the stream is evaluated in the transition area between impaired and non-impaired. Toms Brook scores a 60 on the SCI, waters that are evaluated as attaining their criteria through the SCI score 62 or above. Therefore, Toms Brook's benthic community is only minimally impacted.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis will inform the biologist if the stream's benthic community is impaired. However, it will not inform the biologist as to what is causing the degradation of the benthic community. The composition of the benthic community may leave clues as to the likely stressors. But additional analysis should be performed to determine the pollutants which are causing the impairment. TMDL development requires the identification of impairment causes and the establishment of numeric endpoints that will allow for the attainment of designated uses and

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[1]VADEQ. 1997. 1998 Water Quality Assessment Guidance for 305(b) Water Quality Report and 303(d) TMDL Priority List Report. Richmond, VA.

[2]Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

[3]Ibid 2

water quality criteria.[4] A reference watershed approach was used to determine the stressors and the endpoints for the Toms Brook TMDL. Numeric endpoints represent the water quality goals that are to be achieved through the implementation of the TMDL which will allow the impaired water to attain its designated uses. A reference watershed approach is based on selecting a non-impaired watershed that shares similar landuse, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the conditions needed for the impaired stream to attain standards.

To determine whether a stream was a suitable reference site for the monitored sites, the modelers evaluated the topography, soils, ecoregion, landuses, watershed size, and point source inventory of the potential reference site. A reference site candidate was removed if it was identified as moderately or severely impaired in the biomonitoring analysis. The reference site selected for the Toms Brook watershed was Hays Creek.

The next step in the TMDL development process was to determine the loadings and stressors in the monitored and reference watersheds. Low DO, sedimentation, habitat modification, nutrients, toxic pollutants, and treatment plant upsets were all evaluated as possible stressors to Toms Brook. Ambient water quality monitoring on the streams documented temperature, DO, pH, turbidity, total suspended solids (TSS), nitrogen, and phosphorous.

To get a better understanding of the DO concentrations during the most critical periods, diurnal DO sampling was conducted from August 13-14, 2002 and September 9-11, 2003 on Toms Brook. During this study, DO concentrations were monitored over a 24-hour period. These samples were taken at the end of the summer season when the lowest DO concentrations are expected to be found due to a combination of high water temperatures (lower solubility of oxygen) and low flows. The diurnal DO data also captures the impacts of respiration from primary producers on the stream system. During the evening and early morning hours, these organisms cease photosynthetic operations since there is no sunlight available and consume oxygen. All of the samples collected during this period had DO concentrations in compliance with the applicable criteria. Therefore, low DO levels were not seen as impacting the benthic community on Toms Brook. The Commonwealth also removed excess nutrient loading as a possible stressor, believing that if there were excessive amounts of nutrients being delivered to the stream their impacts would be translated into low DO levels.

Toxicity testing was not conducted in Toms Brook. This was ruled out because the biological community residing in the stream did not support toxicity as a possible stressor. Sediment sampling was conducted in Toms Brook in years prior (1992 and 1996). The 1996 sediment sampling failed to find any contaminant (metals or organic compounds) above the

established probable effects concentration. In-stream ammonia sampling, conducted monthly from 1996 through 2001, failed to reveal any exceedances of the chronic or acute criteria.

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[4]Ibid 2

The discharge monitoring reports for the Toms Brook Sewage Treatment Plant (STP) revealed that there were at least three major process upsets associated with the facility. During these upsets, the ammonia, biological oxygen demand, and TSS concentrations in the effluent increased. Biological monitoring seems to indicate a pattern of higher scores occurring during Fall assessments and lower scores in the Spring. However, the effluent from the facility makes up a small portion of Toms Brook's flow. A 2003 assessment found that the STP made up only 3.2% of the minimum flow, it should be noted that these flows were not among the lowest in the modeled record and during lower flow conditions the effluent may make up a more significant part of the flow. The TMDL found that the STP's average flow 109,000 gallons per day allows Toms Brook to Assimilate the STP's load. Although toxicity sampling on the STP's effluent is ongoing, the biological scores between the STP upsets have actually increased.

There was no clear stressor identified as a result of the stressor analysis for Toms Brook. This makes sense since the stream is minimally impacted according to the SCI analysis, scoring just below nonimpaired. Sediment was determined to be the most probable stressor to Toms Brook because two of the three possible reference watersheds had lower sediment loads, controls for sediment will reduce nutrient loadings as well, and up until the 2002 assessment the embeddedness scores on habitat evaluations for Toms Brook were all low. This indicates that interstitial spaces between gravel and sand were being blanketed by excess sediment. It should be noted that Department of Environmental Quality will continue to evaluate the STP to identify the source of process upsets.

The next step in developing these TMDLs was to determine the sediment loadings to the monitored and reference segments. The Generalized Watershed Loading Functions (GWLF) model was selected as the means to determine loadings to the streams. The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).[5] GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[6] Calculations are made for sediment based on daily water balance totals that are summed to give monthly values. To equate the reference watershed with the monitored watershed, the reference watershed was decreased in size to that of the impaired watershed in the model, the landuses were proportionally decreased by multiplying them by the same factor. Therefore, the landuse breakdown in the reference watershed remained constant.

Local rainfall and temperature data were needed to simulate the hydrology. The Woodstock weather station was used for this TMDL. To insure that the model accurately predicted the stream flow. Since there were no flow gages in the reference or monitored watersheds, the models were not calibrated to observed data. The parameters for the GWLF model were evaluated from a combination of GWLF user manual guidance, AVGWLF procedures, procedures developed during the 2002 nonpoint source pollution assessment, and

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[5]Ibid 2

[6]Ibid 2

professional judgement.[7] The results of the models are documented in Section 6.0 and 7.0 of the report. Table 1 documents the TMDL allocations to the impaired segments.

Table 1 - Summarizes the Sediment Allocations for Toms Brook.

Stream	Pollutant	TMDL (tons/yr)	WLA (tons/yr)	LA (tons/yr)	MOS*(tons/yr)
Toms Brook	Sediment	4,866	8.1	4,371	486

* Virginia includes an explicit MOS by reserving the 10 percent of total loading to the MOS.

The United States Fish and Wildlife Service has been provided with copy of these TMDLs.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing an aquatic life use (benthic) impairment TMDL for Toms Brook. EPA is therefore approving this TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

The impaired segment was listed as impaired due to a degradation of its benthic macroinvertebrate community. As mentioned above, benthic assessments inform the biologist of an impairment, but they are unable to identify stressors conclusively. A stressor identification study was conducted to determine the pollutant that was impacting Toms Brook. Virginia has indicated that excessive levels of sediment have caused the degradation of the benthic community of Toms Brook. The Commonwealth does not have numeric criteria for sediment at this time. Therefore, the loadings obtained from the reference watershed was used as the endpoint for this TMDL. Its believed that if this stream can reduce its sediment loadings to that of the area weighted reference watershed, the impairment to the benthic community will be relieved.

The GWLF model was used to determine the loading rates of the sediment to the stream from all point and nonpoint sources. The TMDL modelers determined the applicable stressor loading rates within each watershed. Data used in the model was obtained on a wide array of items, including landuses in the area, point sources in the watershed, weather, stream geometry, etc..

The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance

[7]Virginia Tech, 2004. Benthic TMDL for Toms Brook in Shenanfoah County, Virginia.

calculations.[8] To equate the reference watershed with the monitored watershed, the reference watershed was decreased in size to that of the impaired stream in the model. Each landuse was decreased in equal proportion, insuring that the landuse breakdown in the reference watershed remained constant. Local rainfall and temperature data were needed to simulate the hydrology, this data was obtained from the Woodstock weather station. In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of agricultural land, land slope, soil erodibility, and farming practices used in the area.[9] Parameters within the model account for these conditions and practices.

EPA believes that using GWLF to model and allocate the sediment loadings to the impaired stream segment will ensure the attainment of the designated uses and water quality standards on Toms Brook.

2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of nutrients and sediment to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis.

Waste Load Allocations

Virginia has stated that there are eight regulated point sources discharging to the impaired segment. Six of these facilities are single family home treatment units and are covered by a general permit allowing for a discharge of 1,000 gpd with a TSS concentration of 30 mg/l. There is one industrial stormwater permit which is allowed to discharge effluent with a TSS concentration of 60 mg/l. The flow for the stormwater permit is based on rainfall and runoff and was determined via the GWLF. The Toms Brook STP was the final permitted facility it has a permitted flow if 189,000 gpd and its effluent can have a TSS concentration of 30 mg/l. The allocated load for the non-stormwater permits can be derived by multiplying the flow by the concentration and 365 after converting the units. It should be noted that permitted facilities often discharge at lower levels and concentrations then their permit requires. The average flow from the Toms Brook STP since 2002 is 109,000 gpd. Therefore, the total loading from the Toms Brook facility may in fact be less than its allocation. Table 2 identifies the permitted facilities in the watershed and their applicable waste load allocation (WLA).

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[8]Ibid 2

[9]Ibid 2

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Table 2 - TSS WLAs for Toms Brook

Facility	Permit Number	Permitted Flow (gpd)	Permitted Concentration (mg/L)	TSS Load (tons/yr)
Toms Brook STP	VA0061549	189,000	30	7.8
RediMix Concrete	VAG110076	Stormwater	60	0.038
Single Family Home	VAG401100	1,000	30	0.041
Single Family Home	VAG401123	1,000	30	0.041
Single Family Home	VAG401469	1,000	30	0.041
Single Family Home	VAG401368	1,000	30	0.041

Single Family Home	VAG401355	1,000	30	0.041
Single Family Home	VAG401427	1,000	30	0.041

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), load allocations (LAs) are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished.

In order to accurately simulate landscape processes and nonpoint source loadings, VADEQ used the GWLF model to represent the impaired watershed. The GWLF model is a comprehensive modeling system for the simulation of watershed hydrology, point and nonpoint source loadings, and receiving water quality. GWLF uses precipitation data for continuous and storm event simulation to determine total loading to the impaired segments from the various landuses within the watershed. Table 3 provides the LA for all of the nonpoint sources of sediment.

Table 3 - LA for Sediment for Toms Brook

Land Use	Existing Load (tons/yr)	Allocated Load (tons/yr)	Percent Reduction
Agriculture	4,448	3,776	15
Urban	76	76	0
Forest	316	285	10
Channel Erosion	259	233	10

3) The TMDL considers the impacts of background pollution.

The reference watershed approach inherently considers the impact of background pollutants by considering the sediment load from all landuses, including forested lands, within the impaired and reference watersheds.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the impaired segments is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[10]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition when the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The GWLF model was run over a multi-year period for the reference watershed to insure that it accounted for wide range of climatic conditions within the reference watershed. The allocations developed in the TMDL will therefore insure that the criteria is attained over a wide range of environmental conditions.

5) The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods. Pollutant loadings also change during the year as vegetation grows making it more difficult for sediments to runoff. Consistent with the discussion regarding critical conditions, the GWLF model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and modifying the soil loss equations based on the time of the year.

6) The TMDL includes a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. Virginia includes an explicit MOS by allocating 10 percent of the total TMDL loading to the MOS.

7) There is a reasonable assurance that the TMDL can be met.

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[10]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDL has been subject to public participation.

Twenty-four people attended the first public meeting for the TMDL on March 27, 2003 at the Toms Brook fire station. On January 13, 2004, the second and final public meeting was held in the Toms Brook fire station. Thirty people attended the meeting. The meeting were all noticed in the Virginia Register and were associated with a 30-day public comment period. Four sets of comments were received on the TMDL.